

closed by ice in several places on the 31st; navigation closed on north branch of Pennsylvania canal on the 17th; on the west branch on the 12th; canal frozen over on the 18th. *Connecticut*.—Springfield, Mass., 22nd, river closed with ice; 29th, river in many places clear of ice; Fall River, Mass., 22nd, North Watuppa Lake, frozen for first time this season. *St. Lawrence river*.—frozen over at Montreal on the 29th. *Newburyport, Mass.*—river and harbor entirely free from ice on 31st. *Lakes*.—Marquette, Mich., harbor frozen over from 18th to 21st. Grand Haven, Mich., harbor frozen over from 16th to 31st. Duluth, Minn., harbor frozen from 12th to 31st. Escanaba, Mich., ice in bay entire month. Port Huron, Mich., navigation closed on the 14th; Ft. Gratiot light extinguished for the season on the 19th. Alpena, Mich., last steamer of season left for Detroit on the 7th; bay full of ice on 12th. Chicago, Ill., lake frozen along the shore on the 15th; navigation closed on the 16th; all vessels laid up on the 17th. Buffalo, N. Y., canal navigation closed on the 6th, lake navigation on the 27th; Buffalo Creek and river frozen over on 26th. Oswego, N. Y., navigation closed on the 1st; all vessels laid up for the winter on the 11th. Detroit, Mich., floating ice in river on the 16th; ice along shore on the 26th. Cleveland, Ohio, navigation closed on the 9th; ice forming along the wharves on the 16th; river frozen over, 18th; floating ice in lake in large quantities on the 26th. Toledo, Ohio, navigation practically closed on the 4th; river partly covered by ice, 13th; frozen over, 16th; navigation closed, 17th. Erie, Pa., harbor lights discontinued for the season. *Lake Champlain*.—Burlington, Vt., ice broken up in river on the 15th; on the 15th at Rouse's Point, Can., 45 vessels fast in the ice, and between Rouse's Point and Sorel 100 vessels ice-bound; lake frozen over from Crown Point to Whitehall; people and teams crossing on ice between Ticonderoga and Bridgeport on the 26th; ice bridge between St. Alban's, Vt., and the islands in the lake firm on the 29th, and 6 inches thick in the thinnest part.

High Tides.—Cape Lookout, N. C., 13th; Macon, N. C., 13th, 14th, 15th, 16th; Atlantic City, N. J., 15th, very high tides, trains delayed in crossing the meadows.

Low Tides.—Indianola, 26th, 27th, 28th, 29th, 30th, 31st.

TEMPERATURE OF WATER.

The *temperatures of water*, as observed in rivers and harbors, with average depth at which observations were taken, are given in table on left side of chart No. II. At the following stations observations were not made on the dates indicated: on account of ice, at Alpena, from 21st to 31st, inclusive; Buffalo, 26th to 31st; Chicago, 15th to 31st; Detroit, 16th to 23rd and 26th to 31st; Duluth, 13th to 31st; Escanaba, 1st to 31st; Grand Haven, 16th to 31st; Marquette, 18th to 21st; Milwaukee, on the 21st and 23rd; Toledo, 16th to 31st. At Cleveland the lake was too rough for observations to be taken on the 7th, 10th, 11th, 15th and 22nd. At Savannah, 15th to 21st; at Punta Rassa, 6th to 31st, and Augusta, 14th to 25th, observations were interrupted by loss or breakage of thermometer.

ATMOSPHERIC ELECTRICITY.

Thunder-storms were reported in the various states on the following dates:—Pennsylvania, 11th; New Jersey, 6th; Maryland, 6th, Virginia, 6th, 26th; North Carolina, 6th; Georgia, 11th, 15th; Florida, 5th, 11th, 15th; Alabama, 5th; Mississippi and Louisiana, 5th, 10th; Texas, 4th, 5th, 9th, 10th, 13th, 23rd, 24th, 31st; Arkansas, 3rd, 9th, 24th; Indian Territory, 4th; Tennessee, 6th, 22nd, 23rd; Ohio, 9th, 21st, 22nd; Indiana, 3rd, 9th, 21st, 22nd; Michigan, 9th, 10th; Wisconsin, 9th; Iowa, 9th; Illinois, 9th, 10th, 21st; Missouri, 4th, 5th, 9th, 21st; Kansas, 4th, 5th, 9th, 30th.

Auroras.—Cornish, Me., 7th, 8th. Fall River, Mass., 12th. Thornville, Mich., 10th, 9 p. m., dimly defined arch with streamers. Argyle, N. Y., 17th, 9 p. m., diffuse light. Cambridge, Mass., regularly looked for at 8 p. m.; suspected, 7th, 9th; decidedly cloudy, 2nd, 3rd, 5th, 6th, 8th, 10th, 11th, 13th, 14th, 16th, 19th, 20th, 24th; some clouds or haze, 4th, 15th; some clouds and moonlight, 1st, 17th, 21st; moonlight, 18th, 26th, 27th; no record, 22nd, 23rd, 25th, 28th, 29th, 30th, 31st; aurora, if present, would have been seen on the 12th. Burlington, Vt., 7th, 11 p. m., an arch of light, of a pale green, with a few streamers above a well defined dark segment; 8th, 9 p. m., diffuse light. Wellsboro, Pa., 12th, 8.20 to 10.30 p. m.; 18th, 9 p. m. to midnight. Newport and Woodstock, Vt., 8th. Manitowoc, Wis., 7th, 11th.

Telegraphic communication interfered with by atmospheric electricity.—Bismarck, 10th, 22nd, 23rd; Coleman and Mason, Tex., 4th; Indianola, 5th, 12th, 18th.

OPTICAL PHENOMENA.

Solar Halos were observed in the various districts on the following dates: New England, 18th to 21st, 23rd to 25th, 28th to 31st. Middle Atlantic States, 1st to 3rd, 16th, 18th, 20th to 25th, 27th to 31st. South Atlantic States, 3rd, 4th, 8th, 11th, 19th to 22nd, 24th, 27th, 29th, 30th, 31st. Eastern Gulf States, 1st, 18th, 19th, 21st, 23rd, 27th, 28th. Western Gulf States, 1st, 2nd, 3rd, 18th to 23rd, 27th. Lower Lake region, 1st, 3rd, 18th, 23rd, 25th, 27th. Upper Lake region, 1st, 2nd, 20th, 24th, 25th, 27th, 28th, 31st. Ohio valley and Tennessee, 1st, 2nd, 19th, 24th to 28th, 30th. Upper Mississippi valley, 1st, 2nd, 6th, 10th, 11th, 15th, 17th, 20th, 24th, 26th to 30th. Missouri valley, 1st, 2nd, 3rd, 4th, 17th, 18th, 19th, 20th to 24th, 27th to 31st. Rocky Mountains, 2nd, 18th, 23rd, 26th, 27th, 28th. Western Plateau, 1st, 21st, 23rd, 26th, 28th, 30th. California, 5th, 23rd. Washington Territory, 4th.

Lunar Halos were observed in the various districts on the following dates: New England, 1st, 2nd, 3rd, 13th, 19th, 23rd to 25th, 27th, 30th; Middle Atlantic States, 3rd, 13th, 26th, 27th; South Atlantic

States, 3rd, 19th, 21st, 25th; Eastern Gulf States, 3rd, 5th, 7th, 11th, 12th, 19th, 21st, 25th; Western Gulf States, 2nd, 7th, 8th, 11th; Lower Lake region, 4th, 13th, 16th, 19th, 23rd, 24th, 27th; Upper Lake region, 13th, 28th, 30th; Ohio valley and Tennessee, 1st, 7th, 8th, 13th, 28th; Upper Mississippi valley, 2nd, 7th, 10th, 11th, 12th, 13th, 14th, 15th, 24th, 25th, 27th, 31st; Missouri valley, 1st, 7th, 8th, 11th, 14th, 16th, 17th, 18th, 20th to 22nd, 24th to 31st; Western Plateau, 17th, 21st, 26th, 27th; California, 9th, 12th, 22nd, 27th; Washington Territory, 14th, 22nd.

MISCELLANEOUS PHENOMENA.

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service Stations. Reports from 131 stations show 4,042 observations to have been made, of which 32 were reported doubtful; of the remainder, 3,264, or 81.4 per cent., were followed by the expected weather.

Meteors.—Belvidere, Ill., 31st; New Corydon, Ind., 13th, 17th, 18th, 26th, 27th; Spiceland, Ind., 1st; Wabash, Ind., 15th, 11:30 p. m., a very large and brilliant meteor passed from SE. to NW., lighting up the whole heavens; Woodstock, Md., 7th, 12th, 13th, 15th, 16th; Westborough, Mass., 12th, 13th; Rowe, Mass., 7th, 9th; Ashley, Mo., 12th; Clear Creek, Neb., 2nd; Austin, Neb., 12th; Freehold, N. J., 16th; Atco, N. J., 17th; Waterburg and North Volney, N. Y., 13th; North Platte, 13th; Castroville, Tex., 11th; Pensacola, Fla., 1st, 10th, 19th; Springfield, Ill., 10th; Madison, Wis., 16th; Chambersburg, Pa., 12th; Ashwood, Tenn., 16th; Maiden Rock, Wis., 30th; Mr. H. H. Ten Broeck, reported the appearance of a remarkably brilliant meteor at 6:45 p. m. It was first observed about 37° above the western horizon moving in a southwesterly direction. It left a trail about 5° long equally dividid into yellow, scarlet and violet bands, lasting about ten seconds when suddenly changing into a yellow cloud it disappeared.

Earthquakes.—United States Naval Hospital, Yokohama, Japan, October 17th, 1879, 1:31 and 2:17 p. m., light shocks; 18th, 1:52 a. m., severe shock, duration 45 seconds; 25th, 0.40 a. m., light shock; 30th, 9.44 a. m., light shock; November 15th, 9.30 a. m., two smart shocks, duration 7 seconds. Two distinct shocks moving from west to east were felt at Charlotte, N. C., and in the surrounding country within a radius of 11 miles, the one at 7 p. m. of the 12th, and the other at 2 a. m. of the 13th. The second was sufficiently distinct to rouse from sleep persons living in Charlotte, Sharon township, Providence, and Pineville. At Los Angeles, Cal., slight shock at 8:15 p. m. of the 7th, lasting about two seconds.

Zodiacal Light.—Monticello, Ia., 8th, 11th, 13th. Cedar Vale, Kan., 11th, 12th, 13th. Yates Center, Kan., 5th, 6th, 10th, 11th, 12th, 13th. Rowe, Mass., 5th, 9th. Oregon, Mo., 13th. Clear Creek, Neb., 12th. Atco, N. J., 1st, 2nd, 12th, 13th. Cambridge, Mass., regularly looked for at 8 p. m.; suspected through haze on the 4th; somewhat visible 7th, 9th, 12th; observations on other evenings hindered by moonlight or clouds. Lynchburg, 30th, 31st. Southington, Conn., 15th. Wytheville, Va., 1st, 3rd, 4th, 6th, 7th, 8th, 12th, 16th.

Prairie and Forest Fires.—Creswell, Kan., 1st, 2nd, 3rd, 8th, 13th to 16th, 20th, 24th, 25th; Dodge City, 10th, 11th, 12th; Fort Sill, 3rd, 7th, 9th, 10th, 15th, 17th; Fort Gibson, 1st, 2nd, 13th, 17th, 26th; Henrietta, Tex., 3rd, 9th, 10th; New Orleans, 29th.

Polar Bands.—New Corydon, Ind., 5th, 13th, 18th, 27th; Tabor, Ia., 27th; Yates Center, Kan., 2nd, 29th, 31st; Gardiner, Me., 8th, 13th, 19th, 28th; Clear Creek, Neb., 2nd, 20th, 27th; Freehold, N. J., 3rd, 28th; Vineland, N. J., 29th; Pembina, 3rd; Milwaukee, 22nd; Wytheville, Va., 7th, 12th, 27th.

Mirage.—Genoa, Neb., 10th, 12th, 13th, 22nd; Pembina, 5th, 11th, 18th, 22nd, 24th, 31st; Cape Lookout, N. C., 3rd; Macon, N. C., 3rd.

Sun Spots.—The following record of observations made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanac Office, Washington, D. C.:—

DATE— Dec., 1879.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		REMARKS.
	Groups	Spots	Groups	Spots	Groups	Spots	Groups	Spots	
1st, 8 a. m.	0	0	0	0	0	0	1	3	} Faculae.
rd, 9 a. m.	0	0	0	0	0	0	1	3	
7th, 8 a. m.	0	0	—	—	0	0	0	0	
7th, 10 a. m.	0	0	0	0	0	0	0	0	
8th, 4 p. m.	0	0	0	0	0	0	0	0	} Spots faint. Faculae.
9th, 9 a. m.	1	3	0	0	0	0	1	3	
12th, 9 a. m.	0	0	—	—	0	0	0	0	
13th, 8 a. m.	0	0	0	0	0	0	0	0	
16th, 4 p. m.	0	0	0	0	0	0	0	0	} These 2 spots have had a large relative motion since morning observation.
16th, 8 a. m.	1	2	0	0	0	0	1	2	
16th, 4 p. m.	0	0	0	0	0	0	1	2	
17th, 3 p. m.	0	0	0	0	0	0	1	2	
18th, 8 a. m.	0	2	0	0	0	0	1	4	
26th, 8 a. m.	0	0	—	—	0	0	0	0	
27th, 9 a. m.	0	0	0	0	0	0	0	0	
28th, 3 p. m.	0	0	0	0	0	0	0	0	
30th, 8 a. m.	0	0	0	0	0	0	0	0	
30th, 2 p. m.	0	0	0	0	0	0	0	0	
30th, 2 p. m.	0	0	0	0	0	0	0	0	

Mr. Wm. Dawson, at Spiceland, Ind., reports "on the 5th, 2 small spots 6' from west edge; considerable faculae in SE. quadrant; air poor. 9th, 3 small spots near centre, much cloud. 16th, 3 small spots 5'